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METHODS OF CHEMICAL ANALYSIS OF SOLDERS FOR USE IN GOLDWARE

PART II DETERMINATION OF CADMIUM AND ZINC BY POLAROGRAPHIC METHOD

UDC 669·215 [621·791·35] : 543·253 : 546·47/·48

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METHODS OF CHEMICAL ANALYSIS OF SOLDERS FOR USE IN GOLDWARE

PART II DETERMINATION OF CADMIUM AND ZINC BY POLAROGRAPHIC METHOD

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Indian Standard

METHODS OF CHEMICAL ANALYSIS OF SOLDERS FOR USE IN GOLDWARE

PART II DETERMINATION OF CADMIUM AND ZINC BY POLAROGRAPHIC METHOD

0. FOREWORD

0.1 This Indian Standard (Part II) was adopted by the Indian Standards Institution on 22 August 1977, after the draft finalized by the Precious Metals Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 Nine grades of gold solders have been specified in IS : 3095-1966*. In order to determine correctly the composition of different gold solders, methods of analysis have been laid down in this standard. This part covers the analysis of cadmium and zinc. The methods for the determination of gold, silver and copper in gold solders have been covered in Part I of this standard.

0.3 In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960†.

1. SCOPE

1.1 This standard (Part II) covers the simultaneous determination of cadmium and zinc by polarographic method in gold solders specified in IS : 3095-1966*.

2. QUALITY OF REAGENTS

2.1 Unless otherwise specified, pure chemicals and distilled water (*see* IS : 1070-1977‡) or deionized water shall be employed in the tests.

NOTE — ' Pure chemicals ' shall mean chemicals that do not contain impurities which affect the results of analysis.

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*Specification for solders for use in goldware.

†Rules for rounding off numerical values (*revised*).

‡Specification for water for general laboratory use (*second revision*).

3. SIMULTANEOUS DETERMINATION OF CADMIUM AND ZINC BY POLAROGRAPHIC METHOD

3.1 Outline of the Method — After separation of gold, silver and copper; cadmium and zinc are simultaneously determined using ammonia-ammonium chloride solution as supporting electrolyte. Half wave potential of cadmium and zinc are — 0·81 V and — 1·33 V versus SCE respectively.

3.2 Reagents

3.2.1 *Dilute Ammonia Solution* — 1 : 1 (*v/v*).

3.2.2 *Gelatine Solution* (*Freshly Prepared*) — 0·25 percent (*v/v*).

3.2.3 *Ammonia-Ammonium Chloride Solution* (2M) — Dissolve 107 g of NH_4Cl in water, containing 134 ml of ammonia solution (r.d. = 0·90) and dilute to a litre and mix thoroughly.

3.2.4 *Standard Zinc Solution* (1 ml = 1 mg *of* Zn) — Weigh accurately 1·00 g of pure zinc metal (99·9 percent). Dissolve in 50 ml of hydrochloric acid (1 : 1) and dilute to a litre.

3.2.5 *Standard Cadmium Solution* (1 ml = 1 mg *of* Cd) — Dissolve 1·00 g of accurately weighed pure cadmium metal (99·9 percent) in 50 ml of hydrochloric acid (1 : 1) and dilute to a litre.

3.3 Procedure

3.3.1 Transfer the solution obtained under **6.4.3** of IS : 7255 (Part I)-1974* into a 250-ml calibrated flask and make up the volume. Take a suitable aliquot (5-10 ml) into a 25-ml calibrated flask and neutralize the solution with dilute ammonia solution using a small piece of indicator paper. Add 0·5 ml of gelatine solution and then 12·5 ml of ammonia-ammonium chloride solution and dilute to the mark.

3.3.2 Take a suitable portion of the solution to a polarographic cell and pass nitrogen gas at a moderate rate (2 bubbles per second) for 15 minutes.

3.3.3 Record a polarogram from — 0·40 V to 2 V.

3.3.4 Measure wave heights of cadmium and zinc respectively.

3.3.5 *Calibration* — Transfer 0, 1, 2 and 3 ml of each standard zinc and cadmium solutions to a 25-ml calibrated flask and carry out the entire stages of procedures as described under **3.3.1** to **3.3.4** and draw a calibration curve by plotting wave heights with respect to their corresponding milligrams amounts of cadmium and zinc.

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*Methods for chemical analysis of solders for use in goldware: Part I Determination of gold, silver and copper.

3.4 Calculation — Convert the polarographic readings of the sample, that is, wave heights, to milligrams of cadmium and zinc from the calibration curve and calculate the percentage of cadmium and zinc as follows:

$$\text{Cadmium, percent} = \frac{A}{B} \times \frac{1}{10}$$

$$\text{Zinc, percent} = \frac{C}{B} \times \frac{1}{10}$$

where

A and C = mass in mg of cadmium and zinc found respectively in the aliquot taken, and

B = mass in g of the sample represented by the aliquot taken for cadmium and zinc respectively.

INDIAN STANDARDS ON PRECIOUS METALS

IS:	
639-1965	Gold leaf (*revised*)
1417-1971	Grades of gold and gold alloys (*first revision*)
1418-1972	Method for assaying of gold in gold and gold alloys (*first revision*)
1953-1973	Methods for chemical analysis of silver anodes (*first revision*)
2112-1962	Grades of silver and silver alloys
2113-1972	Methods for assaying of silver in silver and silver alloys (*first revision*)
2270-1965	Methods for assaying of platinum and platinum alloys
2271-1967	Recommended method for spectrographic analysis of platinum
2275-1963	Grades of platinum
2278-1963	Fine gold bar, sheet, wire, granules and token (*LAGDI* or *MOHUR*)
2279-1963	Fine silver bar, sheet, wire, granules and token (*LAGDI* or *MOHUR*)
2767-1964	Gold thread (silver base)
2790-1964	14, 12 and 9 carat gold
3088-1967	Method for assaying of fine grade palladium
3095-1965	Solders for use in goldwares
3096-1965	Fine grade palladium
3110-1965	Silver leaf
3111-1965	Silver thread
3112-1965	Gold and silver embroidery material
3541-1966	Code of practice for manufacture of 14 and lower carat gold alloys
3571-1966	Dental gold solders
3578-1966	Dental gold alloy wire
3610-1966	Dental gold foil
4134-1967	Recommended colour classification of rough diamond
4704-1968	Silver-tin dental amalgam alloy
4705-1968	Dental mercury
4799-1968	Dental casting gold alloys
5320-1969	Fine silver ingot
5954-1970	Dental white gold alloys
6018-1971	Platinum, platinum-rhodium catalyst gauzes
6019-1971	Platinum dish
6170-1971	Platinum crucible and lid
6683-1973	Diameters for wires of platinum group metals and their alloys
6882-1973	Platinum electrodes
6889-1973	Method for chemical analysis of silver-tin dental amalgam alloy
6890 (Part I)-1973	Methods for chemical analysis of dental gold alloys: Part I Determination of gold, silver, copper, palladium and platinum
6890 (Part II)-1975	Methods for chemical analysis of dental gold alloys: Part II Determination of nickel and zinc
7225-1974	Dental cobalt-chromium casting alloy
7255 (Part I)-1974	Methods of chemical analysis of solders for use in gold ware: Part I Determination of gold, silver and copper
7562-1974	Gold cladding

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Conversion*
Force	newton	N	1 N = 0·101 972 kgf
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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